Sole Inventor

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APPLICATION FOR UNITED STATES LETTERS PATENT

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that I, Sang Hun Oh, a citizen of Republic of Korea, residing at 222 Dongdang-dong, Wonmi-gu, Bucheon-si, Gyeonggi-do, Republic of Korea have invented a new and useful **PLASMA IGNITION METHOD AND APPARATUS**, of which the following is a specification.

PLASMA IGNITION METHOD AND APPARATUS

FIELD OF THE DISCLOSURE

[0001] The present disclosure relates generally to semiconductor devices and, more particularly, to a method and an apparatus for igniting plasma in a semiconductor manufacturing apparatus.

BACKGROUND

[0002] In general, in semiconductor manufacturing devices, the development of photoresists facilitates the patterning of small-dimensioned electronic and optical devices. An example of such photoresists is deep ultra violet (DUV) photoresists. The dimensions of DUV photoresist patterns are considerably smaller than those of conventional photoresist patterns. A metal etching process requires the formation of metal lines having a space smaller than 0.25 μm therebetween.

[0003] However, since such photoresist is sensitive to the reflectance of the metal lines, the reflectance needs to be reduced in order to form a successful pattern of the photoresist. Therefore, an anti-reflective layer of oxide has been used on the metal lines.

[0004] In an in-situ etching of the anti-reflective layer in a metal etching chamber, a gas having fluorine, e.g., CHF_3, has been commonly used. However, in the etching process, a process for forming an initial plasma using a gas having fluorine has a certain drawback in that a higher pressure is required to turn on plasma.

[0005] Therefore, as shown in Table 1 in conventional plasma ignition processes, a preceding step having a higher pressure than that of a succeeding step is introduced to turn on plasma. Those skilled in the art are able to understand that the values shown

in table 1 may vary.

[Table 1]

	Pressure (mTorr)	Source power(W)	Bias power(W)	CHF_3 flow rate (sccm)	Ar flow rate (sccm)
Preceding step	12~20	600~1000	100~200	5~30	50~90
Succeeding step	6~8	600~1000	100~200	5~30	50~90

[0006] However, such conventional processes have a problem in that an error may occur due to a difference in the pressure of a chamber between the preceding step and the succeeding step.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Fig. 1 is a flow chart illustrating an example process for igniting plasma in a semiconductor manufacturing device.

DETAILED DESCRIPTION

[0008] As described in greater detail below, a more stable plasma ignition process in a semiconductor manufacturing device ignites plasma with the use of Cl_2 gas while maintaining substantially same pressure of a chamber. One example method sets a predetermined pressure, source power and bias power of a chamber and flowing a predetermined flow rate of CHF_3 and Ar gases into the chamber, introduces a predetermined flow rate of Cl_2 gas into the chamber, completes the supply of Cl_2 gas, and ignites plasma.

[0009] In another example a plasma ignition apparatus in a semiconductor

manufacturing device includes means for setting a predetermined pressure, source power and bias power of a chamber and flowing a predetermined flow rate of CHF_3 and Ar gases into the chamber, means for introducing a predetermined flow rate of Cl_2 into the chamber, means for completing the supply of Cl_2 gas, and means for igniting plasma.

[0010] A plasma process system usually has a chamber in which an item to be processed is located. An inner space of the chamber is maintained in a vacuum state by using a vacuum pump. Then, process gases are introduced into the chamber so that a desired pressure therein may be obtained. Power supplies, i.e., source power and bias power, are connected to operating circuitry functioning inside of the chamber to perform an initial ignition of plasma. During a plasma process, plasma is applied on the item within the chamber, to thereby carry out coating, etching, cleaning, or other processes thereon.

[0011] Fig. 1 is a flow chart showing an example process of igniting plasma in a semiconductor manufacturing device. As shown in Fig. 1, a predetermined pressure, source power and bias power in a chamber are set. Then, a predetermined flow rate of CHF_3 and Ar gases are introduced into the chamber (block 100). As shown in Table 2, the predetermined pressure preferably ranges about from 6 to 8 mTorr. The predetermined source power and bias power preferably range about from 1 to 10 watts. Further, the CHF_3 gas flows into the chamber at a flow rate of about from 0 to 30 standard cubic centimeters per minute (sccm), and the Ar gas about from 0 to 90 sccm. It will be understood by those skilled in the art that the values shown in Table 2 are only examples and may vary.

[Table 2]

	Pressure (mTorr)	Source power(W)	Bias power(W)	Cl_2 flow rate (sccm)	CHF_3 flow rate (sccm)	Ar flow rate (sccm)
Preceding step	6~8	1~10	1~10	30~150	0~30	0~90
Succeeding step	6~8	600~1000	100~200	0	0~30	0~90

[0012] Then, a predetermined flow rate of Cl_2 gas is introduced into the chamber (block 102). The Cl_2 gas flows into the chamber at a flow rate of about from 30 to 150 sccm.

[0013] Preferably, it takes about 10 to 15 seconds to complete preceding steps, i.e., the blocks 100 and 102 (block 104), and each of the preceding steps can be processed simultaneously or interchangeably.

[0014] Then, the supply of Cl_2 gas is completed while maintaining that of other gases, i.e., CHF_3 and Ar gases, in the substantially same level as in the preceding steps (block 106). Since Cl_2 gas may deteriorate the selectivity of the process requiring high selectivity, the supply of Cl_2 gas is prevented.

[0015] Thereafter, plasma is ignited or turned on by setting source power and bias power to range about from 600 to 1000 watts and about from 100 to 200 watts, respectively (block 108). During ignition, a little Cl_2 gas is used as a residual gas for igniting plasma and then pumped out. At this time, the operations associated with each of the succeeding blocks, i.e., the blocks 106 and 108, may be processed simultaneously or interchangeably.

[0016] The pressure of the chamber can be maintained in the substantially same level. Therefore, the aforementioned problem of igniting plasma may be solved by

using Cl_2 gas without changing the pressure of the chamber. The process of the present invention provides an improved plasma ignition method and apparatus that can be applied at a lower pressure.

[0017] Although certain methods and apparatus have been described herein, the scope of coverage of this patent is not limited thereto. To the contrary, this patent covers all embodiments fairly falling within the scope of the appended claims either literally or under the doctrine of equivalents.